

# SPECIFICATION

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## AMORTISSEUR VIBRATION DAMPER

### Background of Invention

- [0001] This invention relates generally to dynamoelectric machines and more particularly to damping amortisseur bar vibration.
- [0002] Dynamoelectric machines are utilized in many manufacturing applications. Failure of key components within a dynamoelectric machine, such as amortisseur bars, can cause lost production time, injury to personnel, and loss of capital equipment, all of which can reduce profitability. One known cause of dynamoelectric machine failure is motor airgap torque pulsations. When the frequency of these pulsations equal the torsional or ring natural frequency of the amortisseur bars, resonance occurs. In that case the vibratory stresses in the amortisseur bars may exceed a fatigue endurance limit and an amortisseur bar fatigue failure may occur. Subsequently the broken amortisseur bar may bend radially outwards under the action of centrifugal forces and contacts a stator winding end head with harmful consequences.
- [0003] A factor in these failures is the fact that the inherent damping characteristic of amortisseur bars is low. As a consequence when resonance occurs, very small torque pulsations will result in a significant vibratory response, if, and when, the pulsation frequency equals the torsional natural frequency of the amortisseur bars.

### Summary of Invention

- [0004] In one aspect, a method for facilitating damping torsional vibrations of a dynamoelectric machine including a rotor assembly with a first amortisseur bar and a second amortisseur bar extending therefrom and terminating at an endring is

provided. The method includes providing a damping assembly, and positioning the damping assembly between the first amortisseur bar and the second amortisseur bar such that the damping assembly contacts the first and second amortisseur bars, and is substantially proximate the endring.

[0005] In another aspect, an amortisseur bar damping device includes a rigid support member including a first side and a second side opposite the first side, and a first resilient member disposed to the first side and a second resilient member disposed to the second side.

[0006] In another aspect, a damping assembly includes a rotor core, a first amortisseur bar, and a second amortisseur bar. Both the first and second amortisseur bars extend from the core and the second amortisseur bar is substantially parallel to the first amortisseur bar. The damping assembly also includes a damping device contacting the first and second amortisseur bars distal from the rotor core and substantially proximate an endring. The damping device also includes a rigid support member including a first side and a second side opposite the first side, and a first resilient member disposed to the first side and a second resilient member disposed to the second side.

[0007] In another aspect, a motor includes a housing and a stator including a bore therethrough is mounted in the housing. The motor also includes a rotor shaft extending at least partially through the bore. A rotor assembly is mounted on the rotor shaft. The rotor assembly includes a rotor core mounted to the rotor shaft, and a plurality of amortisseur bars extending axially through and projecting from at least one end of the rotor core. It also includes a plurality of endrings connected to each end of the amortisseur bars distal from the core. The rotor assembly also includes an endplate attached to the core, and an amortisseur bar damping device mounted between at least two of the amortisseur bars, the amortisseur bar damping device distal the core and substantially proximate endring.

[0008] In another aspect, an amortisseur bar damping device includes a rigid support member including a first side and a second side opposite the first side. A U shaped channel is disposed longitudinally along the first side. The damping device also

includes a resilient member disposed to the U shaped channel.

## Brief Description of Drawings

- [0009] Figure 1 is a perspective view of a known rotor assembly.
- [0010] Figure 2 is a perspective view of an amortisseur bar damping device.
- [0011] Figure 3 is a partial end view of a rotor taken in the direction of section line II II in Figure 1 including the amortisseur bar damping device shown in Figure 2.
- [0012] Figure 4 is a partial cross section of a rotor assembly taken along section line III III in Figure 3 including the amortisseur bar damping device shown in Figure 2.
- [0013] Figure 5 is an axial view an amortisseur bar damping device shown in Figure 2.
- [0014] Figure 6 is a cross section of a motor.
- [0015] Figure 7 is a perspective view of a different embodiment of an amortisseur bar damping device.
- [0016] Figure 8 is a plan view of the amortisseur bar damping device shown in Figure 7.

## Detailed Description

- [0017] Figure 1 is a perspective view of a known rotor assembly 10. Rotor assembly 10 includes a plurality of rotor core sections 14 disposed about a shaft 12. Each rotor core section 14 includes a plurality of amortisseur bars 16 passing axially therethrough and extending a substantial distance beyond rotor core section's 14 ends. Amortisseur bars 16 extend over an endplate (not shown in Figure 1) that is rigidly disposed to rotor core 14. Amortisseur bars 16 terminate at a plurality of endrings 18. Although five amortisseur bars are shown in each rotor core section 14, more or less amortisseur bars 16 may be employed.
- [0018] Figure 2 is a perspective view of an amortisseur bar damping device 20 including a first member 22, a second member 24, and a third member 26 disposed between first member 22 and second member 24. First and second

members 22 and 24 each include a width 28, a height 32, a thickness 34, and a side 44. Thickness 34 is substantially constant. First member 22 and second member 24 comprise a resilient material and substantially rectangular width 28 substantially greater than thickness 34. In one embodiment, first and second members 22 and 24 are manufactured from vulcanized natural rubber. Alternatively, first and second members 22 and 24 are manufactured from a synthetic elastomer such as neoprene.

[0019] Third member 26 includes a first side 38 and a second side 40 opposite first side 38. First member side 44 is disposed to first side 38 of third member 26, and second member side 44 is disposed to second side 40 of third member 26. In one embodiment, first member side 44 is bonded to first side 38 of third member 26, and second member side 44 is bonded to second side 40 of third member 26. Third member 26 includes a width 28, a height 32, and a thickness 36. Thickness 36 is substantially constant. Third member 26 is machined from a rigid material and substantially cubicle having width 28, height 32, and thickness 36 substantially equal. In another embodiment, third member 26 is rectangular having width 28 substantially greater than height 32. In one embodiment, third member 26 is machined from stainless steel. Alternatively, third member 26 is machined from titanium.

[0020] Amortisseur bar damping device 20 is utilized to facilitate a reduction of torsional vibrations in dynamoelectric machines. It is contemplated that the benefits of amortisseur bar damping devices 20 accrue to all rotor assemblies and motors having amortisseur bars. In one embodiment, amortisseur bar damping device 20 is utilized to facilitate a reduction of torsional vibrations in motors for refiner drives on a sinusoidal power supply.

[0021] Figure 3 is a partial end view of rotor 10 taken in the direction of section line II II in Figure 1 including an amortisseur bar damping device 20 shown in Figure 2. Figure 4 is a partial cross section of rotor 10 taken along section line III III in Figure 3 including amortisseur bar damping device 20 shown in Figure 2. Amortisseur bars 16 extend past an endplate 56 that is rigidly disposed on rotor core 14.

Amortisseur bars 16 terminate at endring 18. Amortisseur bars 16 include amortisseur bars 46, 48, 50, 52, and 54. In an exemplary embodiment, a first amortisseur bar damping device 20 is disposed between amortisseur bar 46 and amortisseur bar 48, and a second amortisseur bar damping device 20 is disposed between amortisseur bar 52 and amortisseur bar 54. First and second amortisseur bar damping devices 20 are positioned substantially proximate to endring 18.

[0022] In one embodiment, amortisseur bar 46, amortisseur bar 48, and amortisseur bar 50 are adjacent such that amortisseur bar damping device 20 is disposed between first amortisseur bar 46 and second amortisseur bar 48, and a second amortisseur bar damping device 20 is disposed between amortisseur bar 48 and third amortisseur bar 50. First and second amortisseur bar damping devices 20 are positioned substantially proximate to endring 18.

[0023] Figure 5 is an axial view of amortisseur bar damping device 20 shown in Figure 2. In an exemplary embodiment, amortisseur bar damping device 20 is mounted to endplate 56 and disposed between amortisseur bar 46 and amortisseur bar 48 with a fastener 58.

[0024] In another embodiment, amortisseur bar damping device 20 may be disposed between at least two or more amortisseur bars 16 by at least one of a weld, a fastener, and a locking plate. In an additional embodiment, amortisseur bar damping device 20 may be disposed between at least two or more amortisseur bars 16 by welding support member 26 to endplate 56 and bonding first and second resilient members 22 and 24 to support member 26 afterwards.

[0025] Figure 6 is a cross sectional view of a motor 60 including a housing 62 and a stator 64 having a bore 66 therethrough. Stator 64 is mounted in housing 62. Rotor shaft 12 extends at least partially through bore 66 and rotor assembly 10 is mounted to rotor shaft 12. Rotor assembly 10 includes a rotor core 14 mounted on rotor shaft 12. Rotor assembly 10 also includes a plurality of amortisseur bars 16 extending axially through and projecting from at least one end of the rotor core 14. A plurality of endrings 18 connecting to amortisseur bars 16 distal from the rotor core 14 and an endplate 56. Rotor assembly 10 additionally includes

amortisseur bar damping device 20 (shown in Figure 2) mounted between at least two amortisseur bars 16 and distal from rotor core 14 and substantially proximate endrings 18.

[0026] Figure 7 is a perspective view and Figure 8 is a plan view of another embodiment of an amortisseur bar damping device 70 including a support member 72 and a resilient member 80 disposed to support member 72. Support member 72 includes a height 74, a length 76, and a thickness 78. In one embodiment, support member 72 is machined from a rigid material, and is substantially rectangular. Height 74 is about 0.900 inches, length 76 is about 5.000 inches and thickness 78 is about 2.000 inches. In one embodiment, support member 72 is machined from a metallic material such as stainless steel. Alternatively, support member 72 is manufactured from a non-metallic material such as a glass laminate, a plastic, and a composite.

[0027] Resilient member 80 includes a length (not shown in Figure 7), a width (not shown in Figure 7), a thickness 86, and a side 88. Thickness 86 is substantially constant. Resilient member 80 is substantially rectangular having the length substantially greater than the width. In one embodiment, resilient member's 80 length is substantially equal to length 76. In another embodiment, resilient member's 80 length is substantially less than or greater than length 76. In one embodiment, resilient member 80 is manufactured from an elastomer such as natural rubber, butyl, and neoprene.

[0028] Rigid support member 72 includes a first side 90, a second side 92 opposite first side 90, and a U shaped channel 100. Channel 100 is disposed longitudinally along first side 90. Resilient member side 88 is disposed to channel 100. In one embodiment, resilient member side 88 is bonded to channel 100. In an exemplary embodiment, amortisseur bar damping device 70 is mounted to endplate 56 and disposed on amortisseur bar 16 by a plurality of locking plates 102 and fasteners 104. Amortisseur bar damping device 70 is positioned substantially proximate to endring 18.

[0029] In an alternate embodiment, U shaped channel 100 is a rectangular channel.

